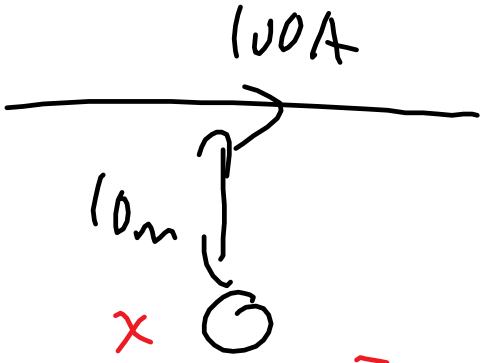
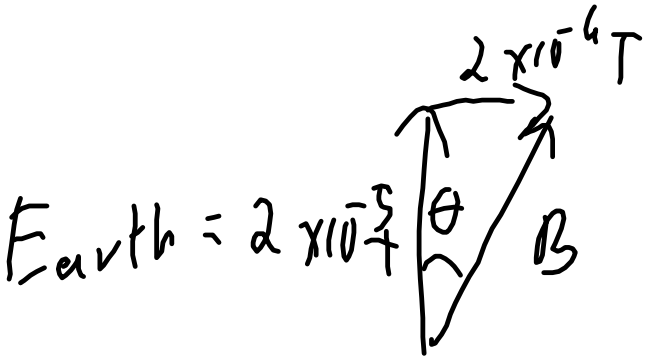
Practice Test

Q1



$$B = \frac{\mu_0 I}{2\pi r} = \frac{2 \times 10^{-7} \frac{Tm}{A} \times 100\,A}{10\,m}$$

$$B = 2 \times 10^{-6}\,T$$

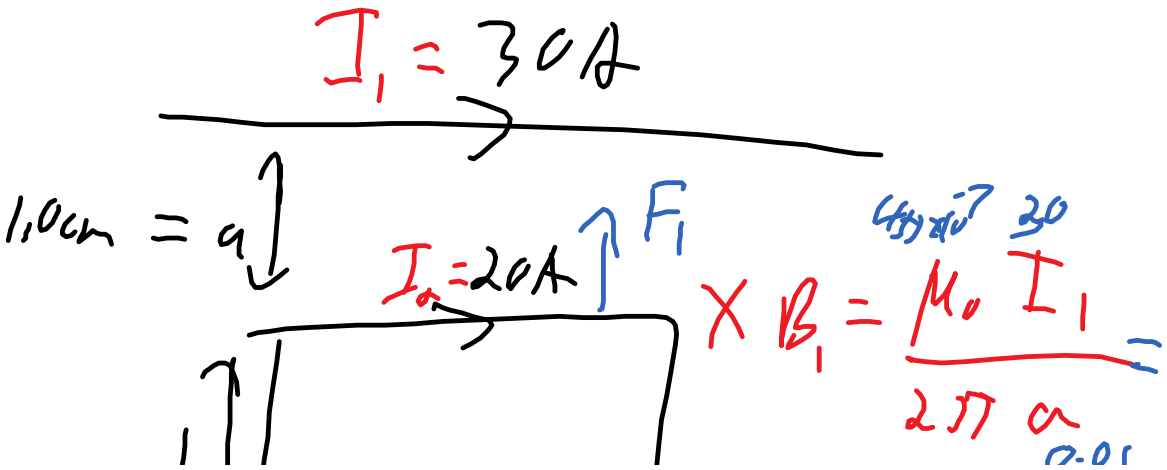


$$\theta = \tan^{-1}\left(\frac{2 \times 10^{-6}}{2 \times 10^{-5}}\right)$$

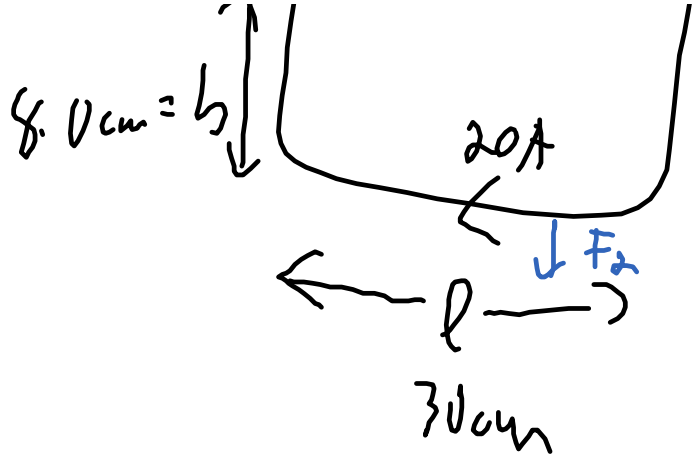
$\theta = 5.7°$ deflection

Significant

Q2



$$B_1 = \frac{\mu_0 I_1}{2\pi a}$$



$2\pi a$ 0.01

$B_2 = \frac{\mu_0 I_1}{2\pi(a+b)}$ 0.01

$B_1 = 6 \times 10^{-4} T$

$B_2 = 6.7 \times 10^{-5} T$

$F_{net} = F_1 - F_2$

$= B_1 I_2 \ell - B_2 I_2 \ell$

$F_{net} = 6 \times 10^{-4} + (20A)(0.3m) - (6.7 \times 10^{-5})(20)(0.3)$

$= 36N \times 10^{-4} - 4N \times 10^{-4}$

$=$ 3.2mN towards the wire

Q3 R=80 Ohms, r=4 ohms

V=100V V_{back} = 88V

$I = V_{net}/R_T$ = (100V-88V)/(80Ω+4Ω)

I = 12/84=0.1429 =0.14A

V_{back}=emf - Ir

Ir = emf-V_{back}

Q4 N_p=2000 N_s = 50

V_p=120V r=0.60Ω

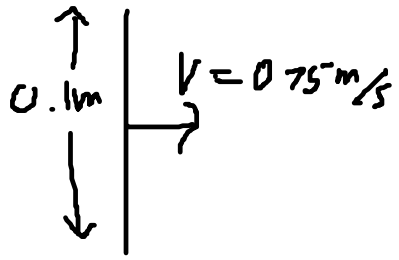
a) $V_s/V_p=N_s/N_p$

$V_s = V_pN_s/N_p$ = 120x50/2000=3.0 V

b) I=V/r = 3.0V/0.60Ω = 3/0.6=5.0 A

c) P=VI = 3x5=15 W

5



emf = BLv = 0.025Tx0.10mx0.75m/s =
0.025x0.1x0.75=0.0019 V = 1.9mV

6. $emf_{max} = 2\pi fNBA$

emf ∝ Bf so $V_1/V_2 = B_1 f_1/B_2 f_2$

96V/140V = B_1 2400rpm/ (2xB_1) f_2

f_2 = 2400x140/(96x2)=1750 rpm

7. emf = -NΔΦ/Δt = NAB/t

= 5.0x10^4 x (4.0 x $10^{-4}m^2$)(2.5x10^{-3}T)/25s

5x4x2.5/25=2

2.0x10^{-3}V or 2.0mV

8.

a) F=qvB = 1.0Cx3.0m/sx3.0N/Am = 9.0N

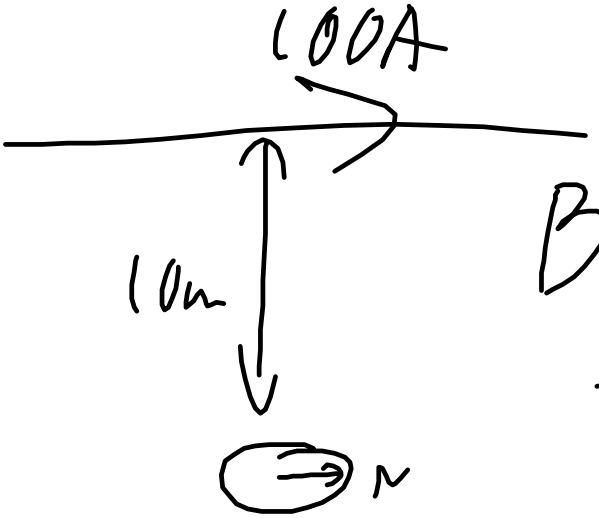
b) F same, same charge, same v and B =9.0N

c) W=Fxd = 9.0N x 0.10m = 0.90J

d) V=Δ energy/q = 0.90J/1.0C = 0.90V

e) I=V/r= 0.90V/0.090Ω = 10A

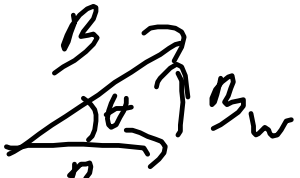
f) F=BIL = 3.0Tx10Ax0.10m = 3.0N



$B = \mu_0 I / 2\pi r$

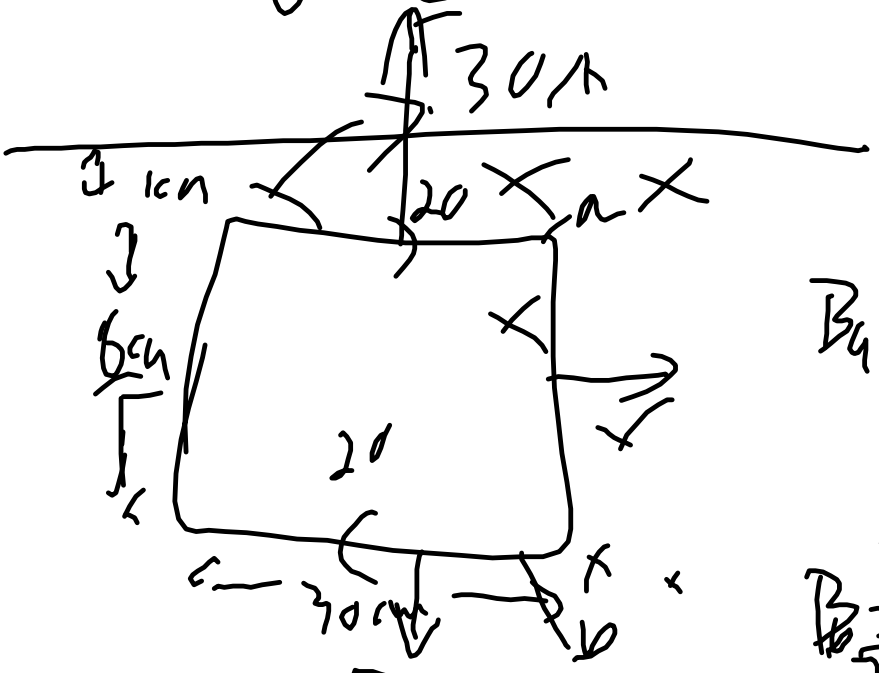
$= 2\times10^{-7}\ Tm/A \left(\frac{10}{10m}\right)$

$= 2.0\times10^{-6}\ T$



$\theta = \tan^{-1}\left(\frac{2\times10^{-6}}{2\times10^{-5}}\right) = 5.7°$

Q2



$B = \frac{\mu_0 I}{2\pi r}$

$B_A = \frac{\mu 30}{2\pi 0.01}$

$= 0.0006\ T$

$B_B = \frac{\mu 30}{}$

$B = \frac{\mu_0 30}{2\pi 0.09}$

$= 0.0000667\ T$

$\vec{F} = \vec{F}_{Ba} - \vec{F}_{BL}$

$= 0.0006\pi(20)(0.30) - (0.0000667)(20)(0.3)$

$= 0.0032\ N$ up

Q3

Total 84 ohms

EMF = 100 Volts

V back is 88 Volts

$V_{back} = EMF - IR$

$88 = 100 - I(84)$

~~$I = 3\ A$~~

$I = 0.14\ A$

Q4 N_p V_p I_s

$$\frac{N_s}{N_p} = \frac{V_s}{V_p} = \frac{I_p}{I_s}$$

$$\frac{2000}{50} = \frac{120}{V_s}$$

$V_s = 3$ V step down

b) $V = IR \quad I = \frac{V}{R} = \frac{3V}{0.6\Omega} = 5A$

c) $P = VI = 3 \times 5 = 15$ W

Q5

$Emf = BLV$

$= 0.025T \cdot 0.75 m/s$

$= 0.1m$

$= 1.875 \times 10^{-3} V$

$= 1.9 \times 10^{-3} V$

$\mathcal{E} = 2\pi f N B A$

$96 = 2\pi (40 hz)(420) B \cdot A$

$BA = 9.09 \times 10^{-4}$

$140 = 2\pi f \cdot 420 \cdot 2B \cdot A$

$f = 29.2\text{Hz} \cdot 60$

$= 1750\text{rpm}$

7.

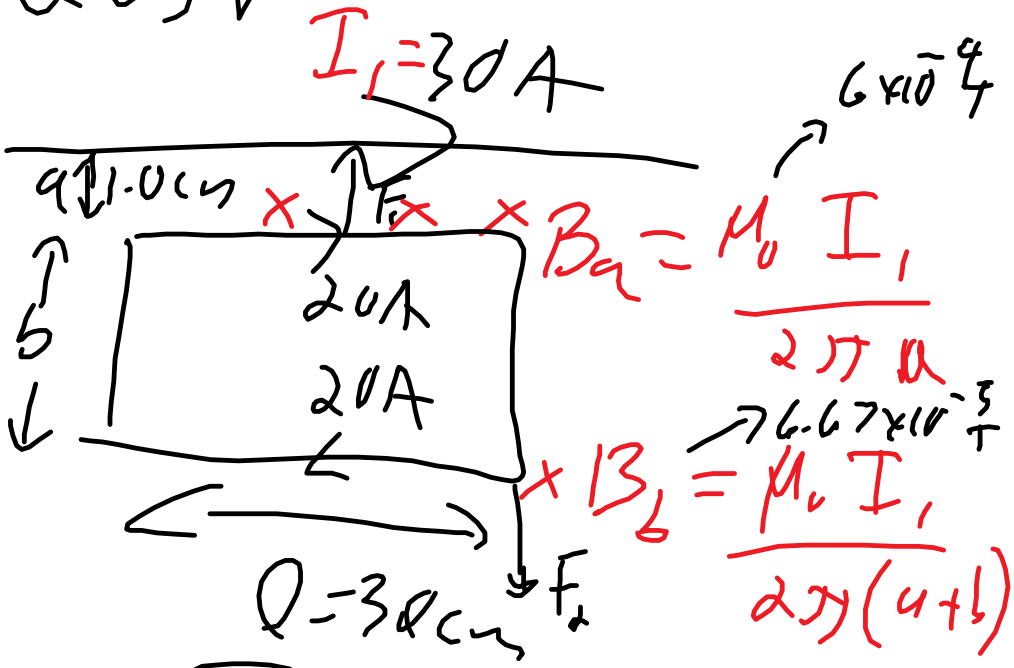
$$\mathcal{E} = -N\frac{\Delta\Phi}{\Delta t}$$

Practice Test

Q1

$$B = \frac{\mu_0 I}{2\pi r} = \frac{(4.0\times10^{-7})(100)}{2\pi(10)} = 0.20\times10^{-5}$$

Q2



$$F = B_a I_2 L - B_b I_2 L$$

$F = 6\times10^{-4}T(20A)(0.3m) - 6.67\times10^{-5}T(2c)(0.3)$

$= \boxed{3.2mN \text{ up}}$

Q3 $V_b = \mathcal{E}mf - Ir$

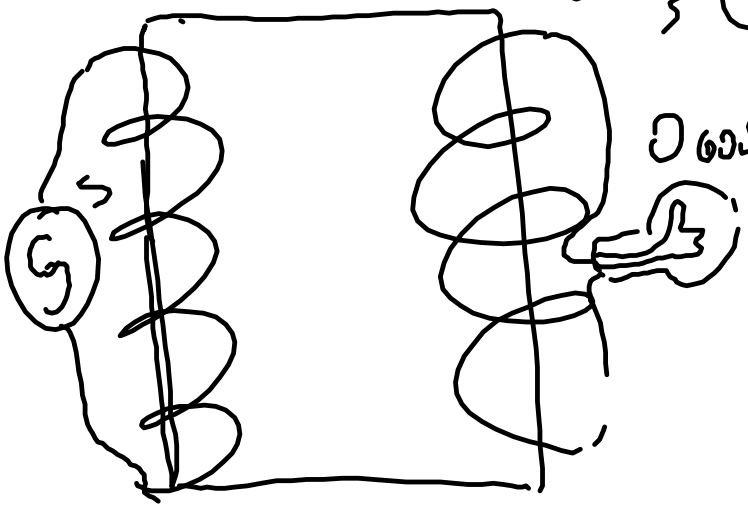
$88V = 100V - I(80+4\Omega)$

$\boxed{I = 0.14A}$

$B = \mu_0 \frac{N_p I}{L}$

Q4 P

$S\ \mathcal{E}mf_s = -\left(N_s \frac{\Delta\Phi_B}{\Delta t}\right)$ $\frac{V_p}{V_s} = \frac{N_p}{N_s}$



$\mathcal{E}mf_p = 120V$

2000 turns

50 turns

$V_s \cdot N_p = V_p \cdot N_s$

$V_s = \frac{V_p \cdot N_s}{N_p}$

$\Rightarrow \frac{(120V)(50\text{ turns})}{2000\text{ turns}}$

$= 3V$

b) $V = I \times R$

$I = \frac{V}{R} = \frac{(3V)}{0.60\Omega} \Rightarrow 5A$

c) $P = I^2 \times R$

$= (5A)^2 \times (0.60\Omega)$

$= 15W$

$I = \frac{V}{R} = \frac{(3V)}{0.60\Omega} \rightarrow 5A$

$= 15\,W$

$$V_s = N_s A \frac{\Delta(N_p I_p)}{\Delta t}$$

$$P_{in} = V_p I_p$$

Q5 $\mathcal{E} = Blv$

$= (0.025)(1\times10^{-1})(.75)$

$= 1.9\times10^{-3}V$

Q6 $\mathcal{E}mf_{max} = 2\pi f N A B$

Constant

$\mathcal{E}mf \propto f \times B$

$$\frac{V_1}{V_2} = \frac{f_1 B_1}{f_2 B_2}$$

$$\frac{96V}{140V} = \frac{2400rpm \; B_1}{f_2 \; (2B_1)}$$

$$f_2 = 1750rpm$$